HAB. Common, nearly everywhere. I have seen the types of Burmeister, Rambur, Selys and Say in Harris collection. Canada, Quebec; Maine, Norway; Massachusetts, everywhere; New York; Wisconsin, Upper Wisconsin River; Illinois; Ohio; Maryland; Kentucky; Kansas; N. Carolina; S. Carolina; Georgia; Washington, D. C.; Tennessee; Florida; Texas.

The species described will perhaps have to be reduced to four. The material known for *C. angustipennis* is decidedly not adequate; if a larger number should prove the differences given for *C. amata* not persistent, the two species will belong together. I acknowledge this to be possible; after our actual knowledge the union can not be proposed on mere guessing.

C. dimidiata and *C. apicalis* have to be accepted as belonging to the same species.

C. aequabilis has nothing to do with *C. dimidiata*. *C. maculata* is very striking, and surely different from all the other species.

C. splendens Hagen Synops. Neur. N. A. 58.6 is surely not to be found here. It was quoted after a specimen in Escher Zollikofer's collection, said to have been sent from Georgia by Abbot.

A CONTRIBUTION TOWARDS A KNOWLEDGE OF TERMITES.[1]

BY BATTISTA GRASSI, CATANIA.

We will begin with *Calotermes flavicollis*. I am able to state that individuals (young nymphs) provided with short wings,[2] wing pad of Hagen, can be developed into supplementary kings and queens.

These supplementary kings and queens are:

1. Individuals (youngest larvae of Fritz Müller) which are not developed enough to be considered either as soldiers (in *Calotermes* there are no workers) or as sexually mature forms with fully developed wings (winged individuals of Fritz Müller.)

2. Sexually mature larvae and nymphs with longer or shorter wings. I have some supplementary kings and queens two and three years of age which show the same characters that they did at the time of their election, and consequently they do not show the slightest development of the wings, the color of the body alone has become darker (yellowish brown).

The sexual organs of the supplementary kings and queens are identical with those of the true kings and queens. The anal appendages which are always present in the true queen are often

[1] Translated from Entomologische Nachrichten, Juli, 1889, 15 Jahrg, No. 14, p. 213–219.

[2] I use this term in the Fritz Müller sense, for the first formation of the wing, just as wing-stump (scale) is used for what remains after the wing is torn off.

wanting in the supplementary queen; they are always present in the supplementary king and the true king.

I have tried very many times to produce supplementary kings and queens, but always with the same results, which I have already published.

We will now take up my observations on *Termes lucifugus*.

The nymphs of the second form (*Lespès*) usually become mature about the month of August, almost always in the nymph form with longer or shorter wings. Their comparison with the supplementary kings and queens must therefore be accepted as proved, although it depends here upon a complicated and unusual phenomenon which gives the colony of *Termes lucifugus* a very peculiar appearance. I have studied the termites for more than five years and among thousands and thousands of *Termes lucifugus* have never succeeded in finding a true king or queen with wing-stumps, that is to say the remaining stumps after the perfect wings have been torn off.

In past years I have had many little colonies of winged individuals confined in cages and later in the natural course met with true kings and queens. If one looks for *Termes lucifugus* about the middle of the month of May in the dead wood of certain kinds of trees he will find youngest larvae, larvae of various stages, many young nymphs of the second form, partly of the male and partly of the female sex, and many individuals incapable of reproduction (workers and soldiers) whilst in other trees, chiefly in the dead roots, in addition to all the above mentioned larval stages and nymphs of the second form, many masses of eggs in different stages of development and hundreds or indeed even thousands of mature females with swollen abdomens and showing a certain quantity of small roundish bodies (spermatozoa) in their spermatheca.

That the above mentioned eggs were laid by these females one can easily convince himself if he will place some of the latter in a frame with a few pieces of moist tender wood—it is understood that the transfer of the eggs has been guarded against—and leave them undisturbed; after one or two days they begin egg-laying and soon find for themselves different nests in the frame. These females can be directly separated from the nymphs of the second form, possessing of course the characteristics already mentioned by me in another place, that is short wings, brown facetted eyes, etc., and are to be compared therefore with the supplementary queens (I shall call them complementary queens.)

In the preceeding month, April, one finds out of doors almost the same conditions except that the nymphs of the second form (there exist neyertheless many larvae capable of reproduction) and the eggs are wanting, whilst the winged forms swarm in hundreds or thousands.

During the winter months (from December to March) the termite colony appears to us almost exactly as it does in April, in place of the winged forms

you find nymphs, that is nymphs of the first form. In general the development of the termites ceases during the winter months. For the autumn months my observations are incomplete. It is nevertheless certain that in the month of August the nymphs of the second form have already become complementary kings and queens; they conceal themselves in the remotest parts of the nest, copulate and the queen lays eggs until November. The complementary kings as a rule die before the beginning of winter, only a few live until December. I have never found one of them after the month of December.

Taking all these important facts together and many others which I have but partially given here we come to the following conclusions; the termite colony produces yearly an immense number of sexually mature individuals. Those mature in spring, acquire completely developed wings (winged forms) and leave the mother nest in order as kings and queens to form a new colony, a happiness however they but rarely share (in this I partly agree with Fritz Müller).

But those which mature in summer acquire only wing-pads, remain in the nest, copulate and reproduce (complementary kings and queens). The complementary kings die before the beginning of winter so that the queens are left alone; the latter cease to lay eggs during the winter and spring, but in May they commence again when they make use of the spermatozoa they have had in their spermatheca since the preceding fall. How long these complementary queens are able to live I do not surely know, but you find some of a dusky (yellowish-brown) color, somewhat like the nymphs of the second form, and others wholly of a dark brown color, many of these have longer wings than the others and this occurs not only with the dark brown forms but also with those of a yellowish brown color. All the complementary queens which are found in the same colony have very nearly the same color and but little variation in the length of the wings. Whilst therefore the difference in color in the complementary queens might at first sight lead us to think that they live several years, my additional facts make it much more probable that they die about the month of August and certainly by the time the new complementary kings and queens mature. The difference in color shows therefore a simple variation just as the difference in the length of the wings. However we will leave the definite solution of this question for future research and we come now to the results of the yearly production of complementary kings and queens. We will suppose that in one place tree A is found invaded by *Termes*, then we shall see after a certain time, that is when the population (living colony) in the above tree A has reached a certain size, the colony extends to the neighboring tree B; the complementary queen however remains in the first tree A. The extension takes place either under ground or directly in the air thus it frequently happens

that we discover the *Termes* underground between two trees occupied by *Termes* or also find trees, the dead parts of which are inhabited by *Termes* without being able to find the slightest sign of a communication with the neighboring nest.

One easily sees that he only has a partial nest from the fact that the complementary queen is found in one of these trees whilst she is wanting in all the others; all other individuals including the youngest larvae are found in both trees only the latter are in far greater numbers in the tree in which the complementary queens are found. If we suppose that the above migration from tree A to tree B to have taken place in the month of March then we shall find in April that nymphs of the second form exist in the tree A as well as the tree B and that in August numerous pairs of complementary kings and queens have developed in both trees from these nymphs of the second form.

In the natural course of time thousands of other trees can be infested from the described tree B and thus a whole territory may be invaded from a single colony; in the same way the *Termes* colony is immortal and compensates for the great difficulty in the foundation of new colonies.

However if we take a fragment of a termite nest without a royal pair at a time when the nymphs of the second form have not yet developed or such a fragment in which only some few of the same are to be found and insulate it so thoroughly that no communication with the mother nest can take place, we shall then see individual *Termes* more or less numerous 20-30-40 which are still undifferentiated (youngest larvae) or young larvae capable of reproduction, that is to say provided only with the first rudiments of the wings, bring forth supplementary kings and queens. It is very probable also that the nymphs of the first form can be metamorphosed into supplementary kings and queens, but I could not determine this, however I deny that the workers or soldiers of both of these stages can be changed into supplementary kings and queens.

The following is another important fact; in each termite nest in which nymphs of the first form, or white winged ones, are found there are always two or three females to one male. On the other hand one will find at the end of the period of swarming, that is at the time when only a few nests swarming with winged individuals are to be met with, in each one of the nests among these winged ones, either only males or only females, very rarely one finds a male among the females.

How these occurrences were related to each other during the time of the greatest swarming I was unfortunately unable to observe, but conjecture that the females were confined to one part of the nest and the males to another part and that they migrated independently of each other and also at two different times. The object of this being to prevent the formation of new colonies between close blood relations, a formation which I sometimes obtained by skil-

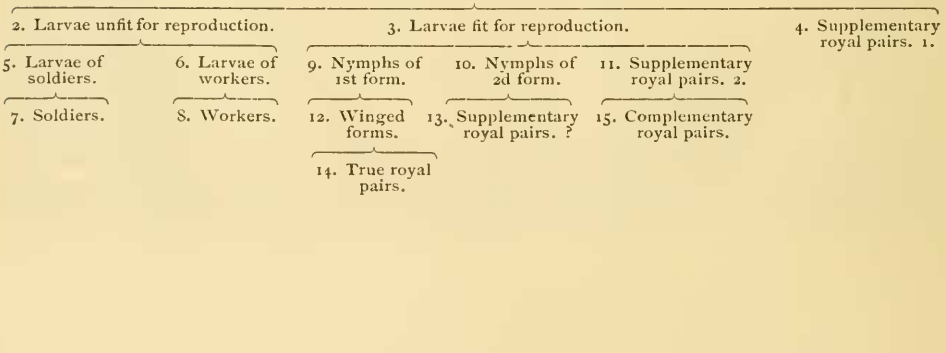
fully placing a certain number of white winged forms taken from one and the same nest beneath a frame. The involuntary inhabitants of these frames changed their color, lost their wings to the scale, copulated and never attempted to leave their case and in May the females began to lay eggs.

In what way are the complementary or supplementary king and queen developed? Alas for this answer I must confess myself at fault but I can state for the *Calotermes* as well as for the *Termes* that all individuals during the time of casting their skins lose the protozoa which they have in their caecum in greater or less quantities. Immediately after casting the skin they acquire them again except such individuals as are designed for supplementary or complementary kings and queens do not acquire the protozoa again (the fact is proved in one to five hundred supplementary and complementary kings and queens from many nests); very soon they become darker colored and by degrees they are sexually mature. Meanwhile the usual food was continued, whether it was at any time added to I do not know but it is certain, as I have already said, that the protozoa do not appear again. But if we consider that the mass of the protozoa in the soldiers, workers and the larvae is always the same, that they change the caecum into a sac which presses on the sexual organs so that one involuntarily believes that these protozoa must be the cause of the infertility of the soldiers and workers[1] and that the *Termes* by avoiding these protozoa can hasten the sexual maturity of the individuals destined for supplementary and complementary kings and queens. In what manner and way this happens I have as yet been unable to discover.

[1] In the nymphs of the first form of the *Termes*, in the nymphs of the *Calotermes*, in the winged forms and the true royal couples of both species the protozoa are found in small quantities.

REVIEW OF THE FORMS BELONGING TO THE TERMITE COLONY.

Termes lucifugus.



CALOTERMES FLAVICOLLIS.

1. Youngest larvae.

2. Larvae unfit for reproduction. 3. Larvae fit for reproduction. Supplementary royal pairs. 3.

5. Soldiers. 6. Nymphs. 7. Supplementary royal pairs. 4.

8. Winged forms. 9. Supplementary royal pairs. 5.

10. True royal pairs.

1. Found only when No. 14, 15 and 11 fail, or the last two present in insufficient numbers.
2. " " " " 14, 15 and 4 " " " " " represented in insufficient numbers.
3. " " " " 10, 7 and 9 fail.
4. " " " " 10, 9 and 4 fail.
5. " " " " 10, 7 and 4 fail.

NOTES ON ASILIDAE.

BY S. W. WILLISTON, NEW HAVEN, CONN.

In the preparation, some time ago, of a catalogue of the South American *asilidae*, and a partial study of a Brazilian collection, I made a number of notes, some of which seem of sufficient interest to publish. The catalogue includes no less than five hundred and forty names, not counting known synonyms, located under seventy-seven genera. The determination of species from among some of these is a dreary task, and in such genera as *Erax*, with its seventy-six "species," or *Mallophora*, with fifty-six, almost impossible, save by the aid of large collections. Undoubtedly there are many synonyms among the names, yet enough must remain to demonstrate the richness of the South American fauna in this family.

In a comparison of the generic names I have found several preoccupied, for which I would propose the following: For *Laparus* Loew, non Billberg, NEOLAPARUS; for *Cylindrophora* Philippi, LYNCHIA, in honor of Enrique Lynch A.; for *Phoneus* Macquart, NEOPHONEUS; and, by the strict rights of priority, in which I fully believe, *Neomoctherus* O. S. must give place to HELIGMONEURA Bigot, and *Andrenosoma* Rondani to NUSA Walker.

It is very singular that Schiner, with his entomological acuteness should have so misunderstood the genus *Senobasis* Macquart, as he seems to have done. Macquart's characters were as follows: "Charactères génériques des Dasypogons. Troisième article des antennes à base très menues et extrémité fort renflée et ovale. Abdomen à base rétrécie; armature copulatrice ♂ à pièces latérales en forme de crochets allongés. Cuisses nues. Ailes: quatrième cellule postérieure fermée, à nervure terminale arrondie." In his figures of *S. analis*